We claim:

1. A random copolymer of propylene with other 1-alkenes having up to 10 carbon atoms,

whose content of comonomers is in the range from 0.7 to 1.4% by weight if the only comonomer present in the propylene copolymers is ethylene, or

whose content of comonomers is in the range from 0.7 to 3.0% by weight if at least one C_4-C_{10}-1-alkene is present as comonomer, and

whose cold-xylene-soluble fraction is from 1.0 to 2.5% by weight if ethylene is present as a comonomer in the propylene copolymers, or

whose cold-xylene-soluble fraction is from 0.75 to 2.0% by weight if the only comonomers present are C_4-C_{10}-1-alkenes.

2. A random propylene copolymer as claimed in claim 1 which comprises exclusively ethylene as comonomer.

3. A random propylene copolymer as claimed in claim 1, which comprises 1-butene as comonomer.

4. A random propylene copolymer as claimed in claim 1, whose Q_5 value is greater than or equal to 200, where Q_5 is given by

$$Q_5 = 1000 \times \frac{\mu(T_m)}{\mu(T_m-5K)}$$

and

$\mu(T_m)$ is the elongational viscosity of the random propylene copolymer at the lowest temperature at which the copolymer is fully molten, and $\mu(T_m-5K)$ is the elongational viscosity at a temperature which is lower by 5K, and the elongational viscosities are determined 2 seconds after stretching begins at a constant strain rate (Hencky strain rate) $\dot{\varepsilon}$ of 0.2 s^{-1}.

5. A random propylene copolymer as claimed in claim 1, whose PI (Processability Index) is greater than 18, where the PI is determined from the formula

$$PI = \ln(SH + 1)\cdot(\ln Q_3 + \ln Q_5),$$

Q_5 is given by

$$Q_5 = 1000 \times \frac{\mu(T_m)}{\mu(T_m-5K)}$$

and Q_3 is given by

$$Q_3 = 1000 \times \frac{\mu(T_m)}{\mu(T_m-3K)},$$

$\mu(T_m)$ is the elongational viscosity at the lowest temperature at which the copolymer is fully molten, $\mu(T_m-5K)$ is the elongational viscosity at a temperature which is lower by 5K and $\mu(T_m-3K)$ is the elongational viscosity at a temperature which is lower by 3K, and the elongational viscosities are determined 2 seconds after stretching begins at a constant strain rate (Hencky strain rate) $\dot{\varepsilon}$ of 0.2 s^{-1},

and the factor SH (Strain Hardening) is the ratio of the maximum gradient of the curve of elongational viscosity plotted against time on a double logarithmic scale for temperatures less than T_m-5K to the gradient of the elongational viscosity curve 1 second after stretching begins at a constant Hencky strain rate $\dot{\varepsilon}$ of 0.2 s^{-1} at a temperature of T_m-5K.

6. A process for preparing random propylene copolymers as claimed in claim 1, in which propylene is polymerized with other 1-alkenes having up to 10 carbon atoms from the gas phase at from 50 to 100°C and at a pressure of 15 to 40 bar in the presence of a Ziegler-Natta catalyst system comprising

a) a titanium-containing solid component comprising at least one halogen-containing magnesium compound and an electron donor,

b) an aluminum compound and

c) at least one other electron-donor compound,

and the ratio of the partial pressures of propylene and of the comonomers is adjusted to from 400:1 to 15:1 and the molar ratio of the aluminum compound b) and the other electron-donor compound c) is adjusted to from 20:1 to 2:1.

7. A method of using the random propylene copolymers as claimed in claim 1 for producing films, fibers or moldings.

8. A film, a fiber or a molding comprising random propylene copolymers as claimed in claim 1.

9. A biaxially stretched film made from random propylene copolymers as claimed in claim 1 and having a stretching ratio of at least 4:1 in the longitudinal direction and of at least 5:1 in the transverse direction.

10. A process for producing biaxially stretched polypropylene copolymer films in which random propylene copolymers as claimed in claim 1 are melt-extruded through a die to give a film, the extruded film is cooled to from 100 to 20°C so that it solidifies, the solidified film is stretched in the longitudinal direction at from 80 to 150°C with a stretching ratio of at least 4:1 and in the transverse direction at from 120 to 170°C with a stretching ratio of at least 5:1.

Random propylene copolymers

Abstract

Random copolymers of propylene with other 1-alkenes having up to 10 carbon atoms,

whose content of comonomers is in the range from 0.7 to 1.4% by weight if the only comonomer present in the propylene copolymers is ethylene, or

whose content of comonomers is in the range from 0.7 to 3.0% by weight if at least one C_4-C_{10}-1-alkene is present as comonomer, and

whose cold-xylene-soluble fraction is from 1.0 to 2.5% by weight if ethylene is present as a comonomer in the propylene copolymers, or

whose cold-xylene-soluble fraction is from 0.75 to 2.0% by weight if the only comonomers present are C_4-C_{10}-1-alkenes,

and a process for preparing the random copolymers of propylene is described, as is their use for producing films, fibers or moldings, and also the films, fibers and moldings themselves and biaxially stretched films made from random propylene copolymers of this type and processes for their production.